ON

GLYCERIN

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A MONOGRAPH

ON

GLYCERIN

AND

ITS USES.

BY

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PREFACE.

The only treatises upon Glycerin with whose existence I am acquainted, those of M. Démarquay and of Dr. William Abbotts Smith, are almost unknown in this country. Most of the facts concerning it are scattered about in various journals; especially in those connected with Pharmacy.

I hope it may prove a not unserviceable task, to the advantage both of physicians and pharmacists, to collate anew these facts; and, without exaggerating anything, to show that in glycerin we have an article with a very wide range of uses, not yet all well determined. Much of the indifference which both druggists and practitioners have displayed toward it may be explained by disappointment resulting from the use of an imperfectly purified article. But, since the means of testing it are now understood to be very simple, it may be hoped that, in the future, its remarkable powers

as a solvent, and advantages as a vehicle, as well as other available properties, may become better known and appreciated.

While claiming the credit only of a compiler in this little *brochure*, I have, at the same time, taken pains to verify the statements given, as far as was possible; and a few suggestions are made in regard to applications of glycerin, to which I venture to ask the attention of practitioners.

For aid in confirming, correcting and extending the accounts of authors in regard to the solvent powers of glycerin, I am especially indebted to Thomas S. Wiegand, chemist, of this city.

H. H.

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ON GLYCERIN.

History.

GLYCERIN was discovered by Scheele, about 1779,[1] in the residuum from the manufacture of lead plaster. It was investigated more fully in 1811, by Chevreul and Pelouze; by the former of whom its present name was given. Gay-Lussac and Chevreul patented a process for separating the fatty acids in 1825; but glycerin was hardly known in commerce in its pure state until the beautiful discovery and invention of Mr. Richard Albert Tilghman, of Philadelphia, patented in 1854; by which it was found to be obtainable absolutely pure by a very simple process.

It was first introduced into medical use by T. De La Roche,[2] in 1844; and, at his suggestion, by Mr. J. Startin, in the London Hospital for Diseases of the Skin. Mr. Warington patented, in 1846,[3] a method for preserving meat in it; and

[1] Gerhardt gives this date. An account is given of the discovery in the Transac. of the Royal Academy of Sweden for 1783.

[2] *Vide* London Pharmaceut. Journal, Nov. 1855.

[3] Ibid.

also pointed out its value in preparing and preserving objects for the microscope.

Cap and Garot investigated it anew, and published their observations in 1854.[1] By them and by M. Surun[2] its solvent powers were principally determined. Many other chemists, pharmacists, and medical men have since given attention to its properties and relations; although, in the language of G. Fergusson Wilson, "not a tithe of its uses have yet been developed."

Occurrence in Nature.

Glycerin does not exist uncombined in nature. It is present in the fat of all animals, including man, in natural *glycerids* or compounds with fatty acids. It is, therefore, evolved in the saponification, by alkalies or basic oxides, of all oily and fatty substances. Spermaceti and wax, however, contain none of it. Gobley[3] found it in the yolk of eggs and in the human brain, in the condition of *phospho-glyceric acid*, or phosphate of glycerin. Berthelot asserts its existence in cod-liver oil,[4] as *triacetin*, or teracetate of glycerin. Pasteur[5] states

[1] Journ. de Pharm. et de Chimie, April, Aug., and Oct., 1854.

[2] *Vide* W. A. Smith, M.D., on Glycerine, p. 23.

[3] Comptes Rendus, T. 21, pp. 766–769, et 988–992.

[4] Miller's Organic Chemistry, vol. iii. p. 259.

[5] Comptes Rendus, May, 1858.

that it is always evolved, in small quantity, in ordinary vinous or alcoholic fermentation. It was formed artificially by Wurtz[1] through a somewhat complicated process; treating the bromide of allyl with acetate of silver; thus obtaining triacetin (teracetate of glycerin), which was saponified by baryta.

Properties.

Glycerin is a colorless syrupy liquid, decidedly sweet to the taste, inodorous when pure, even when rubbed upon the hand. The specific gravity of the anhydrous is 1·28;[2] of the best commercial preparation, having but two per cent. of water, 1·26. At —35° C., it remains unfrozen.[3] Heated to a red heat it burns with a luminous blue flame. At 527° Fahr. it boils. When distilled without water it is decomposed, giving off *acrolein*, $C_6H_4O_2$, a substance very irritating to the eyes, nostrils, and lungs, and having a strongly disagreeable odor, like that of the wick of a candle just blown out. Glycerin is neutral to test paper. It does not evaporate in the air, but absorbs moisture when exposed. It is not liable to become rancid, and is strongly anti-

[1] Comptes Rendus, April, 1857.

[2] Miller, op. citat. p. 274; Muspratt's Applied Chemistry, Art. Glycerine; Brande & Taylor's Chemistry, p. 576; Silliman's Chemistry, p. 441.

[3] Storer's Dict. of Solubilities, p. 291.

septic in its influence upon organic materials. It is freely soluble in water and alcohol, but not in ether. It does not dissolve sugar or gum, but is readily miscible with syrups and mucilages.

As a solvent, glycerin occupies a place between alcohol and water. Diluted glycerin will dissolve some substances not soluble in the anhydrous or in water alone. Its solvent powers being among the most important of its properties, they will be farther stated hereafter.

Upon the skin and mucous membranes, its action is bland[1] and innocuous; causing only, upon prolonged contact, some enlargement of the epithelial cells,[2] with a tendency to their more rapid exfoliation. When the surface is denuded of the cuticle it is still unirritating, although, when not diluted, slightly pungent and stimulant. Taken internally, it is moderately laxative. Dr. S. Weir Mitchell[3] found that the hearts of animals, placed in glycerin, ceased to pulsate sooner than in water or in olive oil.

[1] I have heard it stated that undiluted glycerin is sometimes irritating to the skin when long in contact with it; but the application of it for an hour at a time produces no such effect with myself.

[2] W. A. Smith on Glycerine, p. 37.

[3] Am. Journ. of Med. Sciences, April, 1859, p. 346.

Chemical Relations.

The formula for glycerin is $C_6H_8O_6 = C_6H_7O_5HO = 2(C_3H_2)+O_2+4HO$. The hypothetical radical C_3H_2 was named *lipyl* by Berzelius, and *glycil* by Löwig, while others have designated it as glyceryl. In stearin, margarin, and olein, it is considered by Berthelot to exist as the terstearate, termargarate, and teroleate of glycerin; giving up three atoms of water on entering into combination with the fatty acids. While Heintz avers that margarin is only a mixture of palmitin with stearin, Lecanu, and most other chemists, represent it as a definite glycerid. In butter, the palmitate, butyrate, caprate, caproate, and caprylate of glycerin exist; the first in greatest amount, the others giving the peculiar flavor.

Glycerin is not a fatty body; the oleaginous properties belonging rather to the fatty acids with which it combines. It is not a sugar, although very sweet to the taste, since it will not ferment with yeast at any temperature, and in composition and other relations it does not correspond with the saccharine bodies.[1] It is best classified with the alcohols,—as a "*triatomic* alcohol;" that is, one atom of it neutralizes three of an acid, which would re-

[1] Some facts make probable the view of Berthelot, that all sugars may be regarded as polyatomic alcohols. *Vide* Miller, op. citat. p. 82.

quire three equivalents of soda or potassa for the same effect.

With sulphuric acid it forms (Redtenbacher) *sulphoglyceric acid.* By nitric acid it is decomposed, producing carbonic and oxalic acids. When dropped into a mixture of equal parts of nitric and sulphuric acids, a yellowish liquid may be separated by distillation,—*nitroglycerin,* or *glonoin.*[1] This is powerfully explosive and poisonous, having some resemblance in its physiological action to that of strychnia.

Döbereiner[2] found an acid (glyceric[3] acid) to be developed from glycerin in contact with spongy platinum. Left with yeast for several months it is converted into propionic or metacetonic acid, $C_6H_5O_3$. With old cheese and chalk, or testicular tissue (*Berthelot*[4]), it is gradually changed to a fermentable sugar or to alcohol; the latter only, if carbonate of lime be present.

[1] $C_6H_6(NO_4)_2O_6$; De Vry. One drop on the tongue causes severe pain in the back of the head, of several hours' duration.

[2] Lehmann's Physiol. Chemistry, Phil. ed., vol. i. p. 215.

[3] Glyceric acid is not recognized by Lehmann, or by Brande & Taylor. Miller mentions it without a formula. F. C. Calvert states its formation from glycerin by dilute nitric acid. Journ. of Soc. of Arts, July 29, 1864. Its formula, according to Storer (Dict. of Chem. Solubilities), is $C_6H_6O_8$.

[4] Comptes Rendus, May, 1857; also, Am. Journ. of Pharmacy, Sept. 1857.

Perhaps one of the most beautiful of the triumphs of modern synthetical chemistry, is the formation of true fats by an artificial process, as devised and carried out by Berthelot[1] and De Luca. Glycerin seems to be capable of combining with one, two, or three atoms of acid, in a manner analogous to the power of phosphoric acid to combine, under different conditions, with one, two, or three equivalents of base. Thus are formed *monostearin*, *distearin*, *tristearin*, *monolein*, *diolein*, *triolein*, etc. These may be artificially produced by heating glycerin with the fatty acids for several hours, in closed vessels, to a high temperature; or by mixing the fatty acid and glycerin with chlorohydric, sulphuric, phosphoric, or tartaric acid, and exposing the mixture for several hours to the temperature of boiling water. A partial combination occurs when glycerin and a fatty acid are kept in contact at the ordinary temperature for several months.

Like the "alcohols," glycerin forms, as derivatives, besides the glycerids, or natural and artificial fats, combinations which correspond with the compound ethers; *e.g.* diethylin ($C_{14}H_{16}O_6$); a compound like the simple ethers, as glyceric ether; hydrocarbons, as tritylene; combinations with ammonia, parallel to the ethylic bases; oxidized derivatives, like the aldehyds, *e.g.* acrolein; and an

[1] Ann. de Chimie, III., xli. 216, and liii. 433.

acid oxide, glyceric acid. (*Miller's Organic Chemistry*, vol. iii. p. 275.) Formic acid is one of the results of its decomposition when heated with hydrate of potassa, or with chlorohydric acid and peroxide of manganese.

Manufacture.

Glycerin may be and has been obtained principally in the following modes:—

1. By saponifying olive oil by heating it with an equal weight of litharge; the oxide of lead being mixed with water and added to the oil, with which it is then boiled; fresh portions of water being added to supply the loss by evaporation, until the saponification is complete. The glycerin, dissolved in the water, is then without difficulty separated from the insoluble oleo-margarate of lead, or lead plaster. It is freed from oxide of lead by a current of sulphuretted hydrogen passed through it, the resulting sulphide being removed by filtration; then it is concentrated by evaporation *in vacuo* below 300° F.

As thus prepared, commercial glycerin is not well freed from lead, and it often contains some free fatty acids, giving an odor and a tendency to rancidity.

2. Cap's process (after Frémy) consists in adding sulphuric acid to the mother-waters of the saponification of stearin with lime. After precipitating the sulphate of lime, the clear liquid is boiled,

out of contact with the air, being stirred all the time. The ebullition is designed to remove all the volatile fatty impurities. If litmus show an excess of acid, this is neutralized by chalk or limestone. After filtering, the liquid is reduced by evaporation, and decolorized by animal charcoal. It cannot be, by this means, obtained absolutely pure.

3. By adding to the mother-water of soap factories a slight excess of sulphuric acid, heating with carbonate of baryta, and filtering, evaporating, and treating the concentrated filtrate with alcohol, we obtain glycerin, from which the spirit may be distilled away.

4. A method not much resorted to, is to dissolve castor oil in absolute alcohol, and then pass chlorohydric acid through the fluid. The fatty ethers are washed away by water, and the residuary liquid, on evaporation, gives a tolerably pure glycerin, which may be further improved by digesting it in ether, and decanting off the latter with the dissolved impurities.

5. None of the above modes will compare, either in simplicity of theory or success in practice, with that, the principle of which was originated by R. A. Tilghman in 1854.[1] This plan at first was to act upon either tallow, palm, or cocoa-nut oil, by

[1] Unsuccessful efforts aiming at similar results had before been made by Scharling, Dubrunfaut, and others.

"water, at the temperature of melted lead, 612° Fahr., under pressure." Thus the fatty bodies were broken up into the fatty acids and glycerin; the latter, being the heavier, formed the lower stratum, with the acids above. The acids could then be mechanically separated, and the glycerin concentrated by evaporation. There is no impurity necessarily present in this product, unless, by excess of heat in proportion to the water combining with the glycerin, acrolein may, to some extent, be generated.

G. Fergusson Wilson, F.R.S., modified this process without changing its principle. By injecting steam at the temperature of 550° to 600° Fahr. into a hot solution of fat, he decomposed the latter, allowing the glycerin and the fatty acid to pass over together into the receiver; where, forming two distinct layers, they can be separated. It is in this mode that the best foreign glycerin (that made at Price's Candle Company's works, at Vauxhall, London) is said to be prepared from palm oil. I am not acquainted with the process used in the manufacture of glycerin by Henry Bower, in this city; but, from its being as free as Price's, and more so than any other now sold, from all impurities, it is probable that the principle depended upon is essentially the same. In no other way has it yet been shown that glycerin can be obtained without contamination from odorous fatty acids or metallic ingredients.

Adulterations.

Some of these, as is implied in the foregoing remarks, are the unavoidable results of imperfect methods of manufacture. This is the case with

1. Volatile and odorous fatty acids.

2. Chlorine; present in the form of chlorides in the water employed in the process, or used to decolorize the glycerin.

3. Lime; as in glycerin made by Cap's process, or by one resembling it.

4. Sulphuric acid, or its salts.

Besides these, glycerin may be diluted with water, or adulterated with cane sugar, honey, or glucose. One article, sold to a considerable extent as "German glycerin," was found by H. N. Draper,[1] F.C.S., to consist almost altogether of a solution of glucose, having a specific gravity of 1·436.

Tests.

1. By rubbing a few drops of glycerin over the back of the hand, a somewhat fetid, mouse-like smell will be developed if it contain any of the volatile fatty acids.

2. If chlorine or chlorides be dissolved in it, the addition of a solution of nitrate of silver will pro-

[1] London Chemical News, Oct. 25, 1862; and Am. Journ. of Pharmacy, vol. xi. p. 47.

duce a white precipitate of chloride of silver. Free chlorine will also cause the disappearance of the blue color of a solution of sulphate of indigo to which a little sulphuric acid has been added.

3. Lime will be detected by the oxalate of ammonia; throwing down the insoluble oxalate of lime.

4. Sulphuric acid, free or combined, will, if present, form a precipitate with chloride of barium.

5. Glucose may be ascertained to exist as an adulteration, by adding a solution of potassa to the glycerin and boiling it; it will become brown; pure glycerin does not. On adding liq. potassæ to glycerin, and, afterwards, a solution of sulphate of copper, if glucose be not present the color is not changed by the action of a boiling heat, while glucose will throw down a yellowish-red precipitate of the hydrated suboxide of copper.

6. Glycerin is distinguished from cane sugar by the fact that sulphuric acid will not, without heat, carbonize or decompose it. "One volume of glycerin must be perfectly soluble in one volume of alcohol, acidulated with 1-100th of sulphuric acid, without forming a deposit, when standing in a cool place, even for twelve hours. One volume of glycerin must dissolve in two volumes of a mixture of 100 parts of alcohol and 50 parts of sulphuric acid without leaving syrupy residue." (*Cap.*) Glycerin differs from solution of sugar also in not

polarizing transmitted light. It will not, when pure, ferment with yeast, but will, in contact with it for a long time, be converted into propionic acid. When distilled alone, it evolves acrolein. It is not capable of "caramelization" at any temperature.

7. Glycerin should be neutral to test paper, not affecting litmus even when it is diluted with an equal quantity of water.

Solvent Powers.

The following table is from Cap and Garot:[1]—

1 part of	Sulphur	is soluble in	2000	parts of Glycerin.
"	Sulphuret of Potassium		10	" "
"	Sulphuret of Calcium		10	" "
"	Iodine		100	" "
"	Iodide of Potassium		3	" "
"	Iodide of Sulphur		60	" "
"	Biniodide of Mercury		340	" "
"	Corrosive Sublimate		14	" "
"	Quinia		200	" "
"	Sulphate of Quinia		48	" "
"	Tannin		6	" "
"	Tannate of Quinia		130	" "
"	Muriate of Morphia		19	" "
"	Strychnia		300	" "
"	Nitrate of Strychnia		26	" "
"	Veratria		96	" "
"	Brucia		70	" "
"	Atropia		50	" "
"	Tartar emetic		30	" "

[1] Journal de Pharmacie et de Chimie, Aug. 1854.

The glycerin employed by these authors contained 12 per cent. of water. They further make the following statements:[1] "Glycerine dissolves the vegetable acids, the deliquescent salts, the sulphates of potassa, soda, and copper; the nitrates of potassa and silver; the alkaline chlorides, potassa, soda, baryta, strontia, bromine, iodine, and even oxide of lead. It dissolves and suspends the vegetable alkaloids in the same manner as the aqueous liquids, and at the same time the resulting products may be used for the same purposes as though mixed with oil. Thus, the salts of morphia dissolve in it completely; all when hot, but some when cold separate into clots, which, when triturated with the supernatant liquid, give it the consistence of a cerate, very useful for frictions and embrocations. It is the same with the salts of brucine, strychnine, veratrine, and most preparations of the same order, which enables us to consider that we have now, if not medicinal oils with a vegetable alkaloid base, at least a series of new preparations which will fulfill a perfectly analogous use in therapeutics."

The solutions of the sulphurets alluded to in the table given above, must be kept excluded from the air; on the addition of water only, they exhale the smell of sulphuretted hydrogen. The solutions

[1] Journ. de Pharm. et de Chim., April, 1854. Cap also published a third paper, March, 1856, in the same journal.

of iodine and iodide of sulphur have a smell resembling saffron. An addition of water precipitates a portion of the biniodide of mercury from its solution in glycerin. When heated, glycerin dissolves 1-40th of sulphate of quinine; forming, as it cools, a transparent gelatinous mass. By the aid of heat tannin may be dissolved in 4 parts of glycerin; the solution is thick and cannot be filtered through paper. One part of muriate of morphia may be made into a sort of cerate with 5 parts of glycerin. Camphor is soluble only in 400 parts of glycerin, but more after it has been rubbed up with alcohol or ether.

Cap and Garot believe that, while fats extract from fresh herbs little more than wax, aromatics, chlorophyll, and other coloring matter, glycerin will dissolve gum, sugar, tannin, extractive matter, watery juices, alkaloids, and the aromata. It will also dissolve the aqueous and alcoholic extracts in considerable quantity. Substances are generally, though not without exception, more soluble in glycerin, the more they are so in alcohol.

Dr. W. Abbotts Smith states that 100 parts of glycerin dissolve 0·2 of phosphorus; 0·1 of sulphur; when hot, 1·9 of iodine; the tincture of iodine in all proportions, water not precipitating the iodine from this solution; bromine, ammonia, hypochlorite of soda, acid nitrate of mercury, and nitrate of silver, in all proportions. Only *pure*

glycerin will dissolve nitrate of silver; the presence of chlorine, common in inferior articles, is at once betrayed by a precipitate. Bower's glycerin, and Price's, will be found to stand this test.

One hundred parts of glycerin will dissolve 25 parts of bromide of potassium, 20 of chloride of sodium, 10 of chloride of barium, 50 of chloride of zinc, 7·5 of bichloride of mercury, 2·7 of cyanide, and 32 of bicyanide of mercury; 10 parts of boracic acid, 20 of arsenious acid; sulphuric, nitric, phosphoric, and chlorohydric acids in all proportions. Dr. W. A. Smith also asserts chlorate of potassa to be soluble in it to the extent of 3·5 parts in 100; arseniate of potassa, 50 parts; carbonate of soda, 98; bicarbonate of soda, 8; biborate of soda, 60; carbonate, and muriate of ammonia, each 20; alum, 40; sulphate of iron, 25; sulphate of zinc, 35; sulphate of copper, 30 parts. Of oxalic acid, 15 parts; benzoic acid, 10; acetic, citric, tartaric, and lactic acids, in all proportions.

M. Surun experimented particularly with the alkaloids. He found 100 parts of glycerin to dissolve 0·45 of morphia, codeia in all proportions, 3 parts of atropia (Cap and Garot say 2), 0·25 of strychnia, 2·25 of brucia (Cap and Garot, 1·5), 1 part of veratria, and 1·5 of cinchonia. The alkaloid salts are still more soluble in it; of muriate of morphia, 20 parts in 100; of sulphate of atropia, 33; sulphate of strychnia, 22·5; nitrate of strych-

nia, 4; sulphate of quinine, 2·75; tannate of quinine, 0·75. J. S. Blockey[1] found 1 part of salicin to dissolve in 8 of cold, and 1 of santonin in 18 of boiling glycerin.

A hundred parts of glycerin will dissolve 20 of acetate of lead; acetate of copper, 10; potassio-tartrate of antimony, 5·5; potassio-tartrate of iron, 8; and lactate of iron, 16 parts. Baryta, strontia, lime, and oxide of lead are all somewhat soluble in it.

Alcohol mixes freely with it in all proportions; most tinctures do so also. The exceptions are stated to be those of oleo-resinous bodies, such as musk, castor, tolu, benzoin, assafetida, and camphor. Ether and ethereal extracts and tinctures are not soluble in glycerin.

Vegetable juices are readily dissolved by it; and extracts made with it have great stability. Creasote is soluble in it to a considerable extent, and so is tar; coloring matters, vegetable or animal, very readily. It does not change any of the organic coloring principles, even after long exposure to contact with it.

At my request, Thos. S. Wiegand, of this city, made some experiments in regard to several of the above and other solubilities, with a more concentrated and probably purer glycerin (Bower's) than that of Cap and Garot; containing about 2 per cent. of water, instead of 12. The following were

[1] London Chemist, Sept. 1857; and Am. Journ. of Pharm., Nov. 1857.

the most important results of these experiments; which were conducted with the aid of heat.

Sulphate of quinine was found to be perfectly soluble, in the proportion of eight grains or more to the ounce. Strychnia with sulphate of quinia, (gr. ss of the former with ℈j of the latter, in f℥ij of glycerin) made a perfect solution. The ammonio-citrate of quinine also dissolved perfectly. Iodine and sulphate of quinine required the addition of iodide of potassium to complete the solution.

Morphia dissolved readily, two grains in the ounce of glycerin. Veratria was slow in dissolving, as it is also in alcohol. Creasote dissolved freely, four drops or more in the ounce. Podophyllin was easily dissolved in glycerin while hot, gr. j in f℥j; a *partial* separation only appearing to occur on long standing, cold.

Phosphate of iron dissolved well, ℥ss to f℥ij. Chloride of zinc, quite freely. Labarraque's liq. sod. chlorinat. the same.

Carbonate of lead, without being dissolved to a large extent, was so in sufficient amount to maintain whiteness and opacity in the liquid after standing any length of time; while a large amount of it was suspended by admixture. Of oxide of zinc the same statement precisely may be made.

Phosphate of lime seemed to be nearly insoluble in glycerin. Phosphorus is to a very small degree

soluble with heat. Iodine required *more* than 100 parts to 1 (*Cap and Garot*) to dissolve it. Chloroform, *without trituration*, would not dissolve at all, or even mix with shaking together. Permanganate of potassa *decomposed* the glycerin, with some activity.

Physiological Actions.

When taken internally, glycerin has no perceptible effect except to promote moderately the peristaltic movement and secretion of the bowels. Upon the surface of the body, when covered with cuticle, it is quite unirritating; and to ulcers and wounds it is only mildly stimulant, even when undiluted. So far as might be expected from its known properties, its value for internal use is to be looked for chiefly as a vehicle, for which its extensive solvent powers admirably adapt it; while the same powers also, and its remarkable hygroscopic and antiseptic properties, render it available in many ways for external application. From its composition and chemical relations, we can anticipate nothing very positively in regard to its effects upon the animal economy. Although derived from the fats, agreeing strikingly in taste and consistence with saccharine solutions, and corresponding in molecular constitution with the alcohols, it yet differs from each of these so

much as to make it doubtful *a priori* how far it could act as a nutriment, of the non-nitrogenous series, even *accessorily*. And experience has not shown it to be capable of such power.

Medical Uses.

T. De La Roche and F. Startin[1] first employed glycerin as a remedy in affections of the skin. Some indications, almost universal in them, it fulfills; namely, to keep the skin moist and soft, and to exclude the air, without evaporation. Startin found that when placed in small quantity in a shallow vessel in an oven, while a piece of meat was cooked beside it, it did not lose, but rather gained in weight, by absorption of moisture. Dr. W. A. Smith mentions that the Russians often spread a layer of glycerin on their faces before starting on a sledge journey, to protect the skin against extreme cold; since it will neither evaporate nor congeal at any temperature to which they are exposed.

Mr. Shaw, in 1854,[2] reported the use with advantage of glycerin in the treatment of pityriasis; Trousseau,[3] Bazin, and De Muret,[4] in the same;

[1] Journal of the Society of Arts, March 7, 1846.

[2] Stillé's Therapeutics, from Med. Times and Gazette, April, 1854.

[3] Archives Générales, 5ème sér., iii. 244.

[4] Annuaire de Therap., xvii. 245.

Bougard[1] in eczema, and Stirling[2] in psoriasis. More extensive employment of it, in many affections of the skin, was made by M. Gibert,[3] in the Hôpital St. Louis, with excellent results, especially in combination with other medicaments, in irritative eruptions; such as prurigo, eczema rubrum, impetigo, acne, etc. M. Ancioux,[4] of Belgium, confirmed Gibert's account of its value in such cases as a substitute for lard. Dr. Posner, of Berlin,[5] and Max Richter,[6] of Vienna, also used it, the former to prevent pitting in small-pox, and the latter with iodine, for the treatment of syphilitic and scrofulous swellings and ulcerations. Prof. Hebra[7] found it particularly valuable, made into a caustic with iodine, in cutaneous syphilis. Gueneau de Mussy obtained benefit in pityriasis capitis from its association with muriate of ammonia and rose-water, as reported by Demarquay; and the treatise of the latter author (already alluded to) contains a full account of his own use of it, as well as that of others, in a great many exter-

[1] Bull. de Therap., li. 323.

[2] Edinb. Med. Journal, ii. 921.

[3] Bull. Général de Therap., Aug. 15, 1858.

[4] Am. Druggists' Circular, April, 1859, from Presse Medicale Belge.

[5] W. A. Smith, *op. citat.* p. 51.

[6] Am. Journ. of Pharm., March, 1857, p. 133, from Wiener Med. Wochenschrift.

[7] Allegemeine Wiener Med. Zeitung, 1862.

nal disorders. In lichen, eczema, and herpes (especially herpes zoster) it aids in diminishing the local irritation; in pityriasis, psoriasis, lepra, rupia, pemphigus, and ichthyosis, it softens the skin, and lessens the disposition to the formation of dry, thick, and hard scales or crusts; while in impetigo, ecthyma, acne, favus, mentagra, scabies, etc., it not only meets the same indications, but answers much better than lard, as a vehicle or adjuvant, in the application of the various agents desired. Thus M. Bourguignon[1] employed it for the preparation of the most elegant application for itch that, perhaps, can be used; to which we will allude again hereafter. The advantages of glycerin over lard for such uses are, particularly, that it is not at all liable to rancidity; that it can be removed at any time without soap or unpleasant friction; that it does not soil and grease the garments and bed-clothing; and, perhaps, most important of all, that it dissolves or combines with the active principles more perfectly than any oil or fat, and, more readily than any such substances, may be absorbed by or distributed through the skin. Of course, occasional disappointments will occur, especially where too much is expected from the action of the glycerin itself; as when M. Devergie,[2] probably with an impure

[1] Med. Times and Gazette, Oct. 29, 1859.

[2] Bull. de Therapeut., l. 241.

article (such having been often and largely used), thought its action irritating to the surface, while he also found fault with its *moistening* the skin so constantly; an effect certainly desirable in most cases of cutaneous disorder, but requiring judicious management as well as limitation. Dr. Joseph Bell,[1] of Glasgow, giving it a trial as a preventive of pitting in small-pox, thought it irritating, and describes it as drying up very soon after its application. It is highly probable that both of these defects belonged to the imperfect purification of the glycerin employed; since, when pure, it has not been found, in burns and bed-sores,[2] any too stimulant; and the "drying up" spoken of by Dr. Bell (the very reverse of what Devergie objected to) ought not to belong to undiluted glycerin. Dr. Bell was also disappointed in the action of collodion, used with the same intention; because the contraction resulting from it produced too much pressure and secondary congestion. Had he thought of combining these two agents, as proposed by Cap and Garot,[3] he would have found the collodion to be deprived in great degree of this tendency, and rendered much more available for its purpose.

[1] Glasgow Med. Journal, July, 1861.

[2] Dr. C. F. Moore, in Dublin Med. Press, Dec. 26, 1860.

[3] Journ. de Pharm., Aug. 1854; *vide* Am. Journ. of Pharm., March, 1855.

Dr. Stillé is right, at the same time, most probably, in concluding[1] that the action of glycerin is rather protective than alterative. It must depend for any powerful action of the latter kind, upon materials combined with it; but its protective properties are so decided, and its solvent powers and affinities so remarkable, that its *rôle* in the treatment of skin diseases is likely to become still more extended.

The cutaneous affections in which it appears to have proved most especially beneficial, *per se* or as an excipient, are as follows.

In *erysipelas*, Dr. W. Abbotts Smith[2] states that it, more than any other agent, modifies the symptoms; "allaying especially the smarting pain and acrid burning heat, so that the benefit of the soothing effect produced by its local application is soon evinced by the improved general condition of the patient." Dr. Edward Hartshorne has found that, in *scarlet fever*, it acts more favorably upon the skin than lard.

In *prurigo*, either *simplex*, *senilis*, *podicis*, or *vulvæ*, Demarquay and others have found it give great relief. If, as has been asserted,[3] sulphur, tar, and corrosive sublimate are, for this affection,

[1] Treatise on Therapeutics, etc., vol. i. Art. Glycerin.

[2] *Op. citat.* p. 50.

[3] Von Bärensprung; Brit. & For. Medico-Chirurg. Review, July, 1860, p. 247.

almost specifics, we may have no doubt that, as it may be used as a vehicle for either of these, it is much better than lard for such use. The same remark might be made in regard to it in the treatment of all the parasitic diseases of the skin; in which the writer is among those whom observation has convinced of the *importance* as well as existence of parasitic growths, which often require *specific* treatment for their destruction in order to the cure of the case.

Pityriasis, *ichthyosis*, *psoriasis*, etc. have already been alluded to as indicating the use of a remedy which softens and moistens the skin. Nothing will do this so effectually, agreeably, and permanently as glycerin. In *rupia* and in *pemphigus*, its frequent application (with a large hair pencil, for example), either by itself or with some sedative or alterative contained in it, will have a most favorable influence over the eruption. It may be remembered that it is very easy to dilute it with water, if a partly excoriated surface should appear too sensitive to it; but that is unlikely to occur if pure glycerin be employed.[1] The preparation which seems to have met with most favor

[1] For *maculæ*, or discolorations of the skin (ephelides, chloasma, lentigo), I propose a lotion of glycerin with dilute nitro-muriatic acid; a portion to be left in contact with the part for some time.

is a combination of glycerin with starch; the history of which is, in brief, as follows.

F. Startin, in his papers before cited, published in 1846 and 1847, proposed as a substitute for unguents, a compound made with gum tragacanth, glycerin, lime-water and rose-water; described as an elegant and convenient material for external use. Cap and Garot, in 1854, mention in one of their articles, also previously quoted, that "starch and glycerin in equal quantities form a sort of pomade; which may be mixed with salts, alkaloids, extracts, tar, etc." The same qualities, they say, attend the addition of 1 part of powdered althea to 3 parts of glycerin. In the Hôpital St. Louis, at Paris, M. Gibert made large use of a similar menstruum, especially for tar. The "glycerole de goudron," employed by him,[1] consisted of glycerin 30 parts, starch 15 parts, and purified tar 1 or 2 parts, mixed homogeneously by the aid of heat. Mr. Brady uses 6 oz. glycerin, 6 oz. tar, and 2 dr. powdered starch.[2] In 1858, G. F. Schacht proposed[3] the name of *plasma* for the mixture of starch with glycerin; his formula being, 1 fluid-ounce of glycerin, with 70 grains of powdered starch; mixed cold, and heated gradually to about 240° Fahrenheit, stirring constantly. A corre-

[1] Bull. Gén. de Therap., Aug. 15th, 1858.

[2] Am. Journ. of Med. Sciences, October, 1862, p. 515.

[3] Lond. Pharm. Journ., Feb. 1858.

spondent of the journal in which his article appeared, justifies the name of plasma as classically correct, by a passage from Persius; in which that word is used for a *gargle* or throat-wash.[1] In one of the German journals, somewhat later, credit was given to Dr. Simon, of Berlin, for the introduction of a very analogous composition. His proportions were different, viz., five parts of glycerin to one of starch; forming a soft, butter-like substance. Under the name of glyceramyl, or amylo-glycerin, a similar compound has been employed here by several practitioners. My experience with it has been sufficient to convince me of its great value in cutaneous eruptions; especially where considerable heat and irritation exist; in many of which cases fatty ointments do not suit well, and seem even to aggravate the disorder.

Glycerin has been found of service in certain conditions of deafness, as Dr. Turnbull,[2] of London, has shown; it being more useful than water in carrying out the ingenious expedient of Yearsley, of supplementing a deficient *membrana tympani*

[1] Scilicet hæc populo, pexusque toga recenti,
Et natalitia tandem cum sardonyche albus,
Sede leges celsa, liquido cum *plasmate* guttur
Mobile collueris, patranti fractus ocello.
Sat. I., *v.* 15–18.

[2] London Med. Gazette, June, 1849; and Stillé's Therap., vol. i. p. 155.

by a moistened pellet of cotton. Dr. Turnbull also used dilute glycerin to cleanse and lubricate the Eustachian tube; and Mr. Wakley[1] and others have found it very useful in epithelial thickening of the lining of the *meatus*, with or without waxy concretions.

In ophthalmic surgery, frequent and extensive use has been made of glycerin. For morbid dryness of the cornea, Dr. W. Abbotts Smith considers it one of the best of applications, when combined with $\frac{2}{3}$ or $\frac{3}{4}$ of distilled water. Where the eye is always open from paralysis or injury of the upper lid, I should anticipate great advantage from the permanency of its moisture. Bowman recommends its application after cauterization of the conjunctiva. M. Foucher, of the Hôpital des Enfans, Paris, advises it in all cases of ophthalmia, especially ophthalmia tarsi.[2] In place of water, he formed collyria with it, of borax, sulphate of zinc, sulphate of copper, perchloride of iron, tincture of opium, etc. Calomel, though not soluble,

[1] London Lancet, July, 1852.

[2] Prof. Gräfe recommends a combination of glycerin with red precipitate for phlyctenoid ophthalmia and its sequelæ. He adds, "when a tendency to turgescence of the conjunctiva and to granulation is observed, pomades made of starch and glycerin are in general more efficacious than all others."—*Journ. de Médecine et de Chirurgie Pratiques*, July, 1863.

may be suspended in it, and so applied. The nitrate of silver is quite compatible with pure glycerin; the impure will precipitate with it the chloride of silver. For the application of atropia to the eye, so often resorted to since its substitution for belladonna by Reisinger, C. R. H. Tichborne has shown[1] that its solution in glycerin has great advantages. As much as 4 per cent. will dissolve; but he found one-half, or even one-fourth per cent. usually sufficient to dilate the pupil strongly. By first adding a few drops of alcohol to the atropia, and then mixing it with the glycerin, a heat of 110° Fahr. for half an hour being allowed to drive off the spirit, he obtained a definite solution; which will keep better than an aqueous solution, and act more fully by absorption through the skin. M. Follin,[2] of the Salpêtrière, adds subnitrate of bismuth to glycerin (1 or 2 parts to 3 parts) for application in chronic granular conjunctivitis, ciliary and glandular blepharitis, etc.; and Debout and Trousseau have used the same combination for irritations or excoriations, etc. of other parts of the body.

In fissures of the tongue and ulcerative affections of the mouth and throat, glycerin has been

[1] Am. Druggists' Circular, December, 1860; from London Chem. News.

[2] Bull. Gén. de Therap., vol. lxiii.

found useful, by itself or in combination. In croup, Dr. E. R. Mayer[1] employed it, as he reports, with decided benefit as an application to the glottis. Dr. S. Scott Alison used it in an analogous manner.[2] In ozæna it is recommended not only by its blandness, but by its antiseptic property, as the best material for injections, containing astringents or alteratives, to the mucous surface. I suggest its substitution for honey in the wash often so useful in *diphtheria*, of equal parts with muriatic acid.

In chilblains it is an excellent emollient; especially in association with tannin, with alum, or acetate of lead, oxide of zinc or subnitrate of bismuth.

For ulcers, Demarquay preferred it as the first dressing, followed, in his treatment, by compression with adhesive plasters. It makes an exceedingly *clean* dressing, and gives a gentle and salutary stimulation to the granulating part.

In open cancer, it diminishes suppuration, lessens greatly the odor, and keeps down fungous growths. Opium, belladonna, etc. may be added to it for palliative effects. I propose for trial a saturated solution of *creasote* in glycerin as a local application for *cancer*. Without yet having had an opportunity to employ it, I am sanguine of its

[1] Am. Journ. of Med. Sciences, April, 1858, p. 338.

[2] Medication of the Larynx and Trachea, p. 20.

being found to retard the spread of carcinomatous growths, by the *coagulating effect of creasote upon albuminoid tissues and transudations;* the glycerin aiding in the introduction of the potent agent more effectually and more protectively than water. Van Holsbeek found a tent saturated with a solution of tannin in glycerin (1 part to 16) an excellent remedy for fissure of the anus.[1]

Demarquay injected glycerin with great advantage into fistulous abscesses and sinuses, with or without diseases of the bones; sometimes adding iodine. I am not aware of its trial in gonorrhœa; but would expect a good effect from it. In leucorrhœa it was found beneficial by Demarquay, used in a tampon with tannin (1 part to 4 of glycerin).[2] For sore nipples, especially where cracks exist, I am confident that no other local treatment will produce so good results as the application, with a camel's hair pencil, of collodion, to which one-fiftieth of glycerin has been added. Wakley recommends glycerin as the best material to soften corns, preparatory to their excision.

In the treatment of burns and scalds, Dr. W. A. Smith insists that glycerin alleviates the pain, and often causes its complete disappearance. "It substitutes for the sensation of heat that of cool-

[1] Stillé, op. citat. vol. i. p. 156.
[2] Bull. de Therap., l. 540.

ness, which continues in consequence of the property which glycerine possesses of absorbing moisture; it also penetrates into the part, moistens and softens it, and obviates the dryness and tension; besides which, it prevents the pain which would be produced by the contact of the surrounding air."[1]

Maisonneuve as well as Demarquay and others have reported most favorably of glycerin as a dressing for wounds. If pure, it produces no painful sensation when applied to a wound. Demarquay advises the saturation of linen with it for such application; it does not require so frequent renewal as the water-dressing; is deodorizing, cleanly, and easily removed; and lessens the amount of suppuration.

The tendency to gangrene is strikingly opposed by the local action of glycerin. This was pointed out by Demarquay in a communication to the Society of Surgery of Paris. While doubting its sufficiency in many cases alone, I should recommend it instead of water for the solution of *bromine*, so successful in treatment of hospital gangrene, in the hands of Surgeon Goldsmith,[2] U. S. V.; or, with carbolic acid,[3] or coal tar, relied upon by

[1] *Op. citat.* p. 47.

[2] Am. Med. Times, Sept. 12th, 1863.

[3] C. Calvert and T. Turner; Lancet, Sept. 26th, 1863.

others;[1] or, as used at the Bicêtre,[2] with chlorate of potassa, one part to 6 or 8 of glycerin.

One other suggestion of a surgical kind may be made; that, in those curious and distressing cases of *nerve-wound* reported by Drs. Mitchell, Morehouse, and Keen,[3] in which "burning pain" affects a part of the surface to an intense degree and almost irremediably, glycerin might more perfectly and more conveniently than water maintain that *moisture* of the part which the patient seems instinctively to crave.

Internal Use.

In quantities varying from a drachm to an ounce, according to age or susceptibility, glycerin, taken internally, is mildly laxative. On account of its sweetness it is easily administered to children. As all physicians and parents well know, a *pleasant* aperient is an important desideratum in infantile therapeutics. I have used glycerin in this way, enough to find that it has no inconvenient or objectionable quality which should prevent it being recommended as a domestic medicine. Nothing else of similar effect,

[1] Demeaux; Lond. Med. Rev., Feb. 1861.

[2] Ploss; Verges' Zeitschrift, N. S., vol. i.; and Med. Times and Gazette, May 30th, 1863.

[3] Wounds of Nerves and Nerve-centres; Philada. 1864.

except manna, is equally acceptable to the taste; and I think the latter no more reliable for the purpose. Purgative principles, such as podophyllin, aloes, etc., may be dissolved in the glycerin, where a more powerful operation is required.

Dr. Crawcour,[1] of New Orleans, made trial of glycerin in place of cod-liver oil in the treatment of phthisis; and reported very favorable results. He gave it in the dose of from one to three drachms, three times daily; not only in pulmonary phthisis, but in different forms of scrofulous and mesenteric disease. In the consumptive, he stated that the cough was relieved, digestion improved, and deposition of fat increased, in a short time. Iodine and iron, associated with glycerin, seemed to do more good than when alone. He also took, himself, a solution of phosphorus in glycerin (2 grains to the fluidounce of the *hot* liquid); and considered less than a quarter of a grain of phosphorus, so dissolved, to be an excitant dose. Dr. Lauer Lindsay, of Perth,[2] thought favorably of glycerin in the treatment of phthisis.

Dr. Cotton,[3] of the Brompton Hospital for Consumption, in a series of therapeutical experiments extending over five years, compared glycerin with

[1] New Orleans Med. News and Hospital Gazette; and N. Y. Journ. of Med., March, 1855, p. 309.

[2] W. Abbotts Smith, op. citat. p. 39.

[3] Lancet, Oct. 25th, 1862.

other remedies. His conclusion was, that in phthisis it "failed very generally; and its effects could bear no comparison to those of cod-liver oil." Dr. Da Costa of this city made a trial of it for several months, in the wards of the Episcopal Hospital, in consumption; but discovered no benefit from it. I do not see, indeed, any reason why we should anticipate any favorable action from it in phthisis, unless as an expectorant. That it might often be substituted with advantage for syrup in ordinary expectorant preparations, is, I think, very probable.

Dr. Daude[1] and others have used glycerin with good effect in dysentery; both by the mouth and by injection into the rectum. One part of it to five of flaxseed tea makes a bland emollient, very soothing to tenesmus.[2] It would probably be a good emollient for irritated piles.

In ulcer of the stomach, it is likely to act kindly, especially in combination with creasote, or with nitrate of silver. Sugar, when swallowed, often causes pain in an ulcer of the stomach, very much as it does in a carious tooth; but glycerin, so far as I am aware, does not produce this effect.

I suggest its use instead of sugar in the regimen of diabetic patients. Not being saccharine either

[1] Am. Journ. of Pharm., March, 1861; from Pharm. Cent. Halle I. No. 6.

[2] Stil'é, op. citat.; from Bull. de Therap., lviii. 521.

in composition or capacity of fermentation, its sweetness may be indulged in without liability to increase the disposition to *glucogenesis*. If, as Dr. Champouillon avers,[1] sugar be especially injurious as an article of food in *phthisis*, the same substitution would be equally suitable there also. The opinion of that author, however, though based upon a good deal of supposed experience, requires to be tested by further inquiry. The frequent craving of sweet things by phthisical persons renders it, *a priori*, improbable.

It has been proposed to inject glycerin into the bladder to dissolve phosphatic calculi; but I have not heard of its being tried, and should not anticipate its success.

Pharmaceutical Uses.

Cap and Garot proposed the name of *glycerole* for any solution in, or compound of glycerin, other than the natural or artificial fats. Chemists now reserve the name of *glycerids* for the fats or other neutral compounds of glycerin with an acid. The term *glycerate* belongs to glyceric acid salts. *Glycerolate*, used by Dr. W. Abbotts Smith, is clumsy; so that the term of Cap and Garot may be adopted as the best.

[1] Dublin Med. Press, Feb. 24, 1864; from Journ. de Med. et Chirurg.

To the universal employment of glycerin in the place of lard in ointments, liniments, etc., the only objection appears to be its present greater comparative cost. This is not, however, at all so great as to prevent its being preferred in several important preparations; either by itself or in the form of glyceramyl, or "plasma." F. Baden Benger[1] urges its advantage especially as an excipient where ointments are prone to rancidity, as Cerat. Plumb. Acetat., Ung. Zinci, etc., or where the active ingredient is soluble in glycerin, as Ung. Potass. Iodid., Ung. Aconitiæ, Ung. Atropiæ, Ung. Veratriæ, Ung. Belladonnæ, and Ung. Creasoti. I cited on a previous page Tichborne's account of the convenient glycerole of atropia for ophthalmic purposes. One ounce of glycerin is capable of dissolving fifteen grains of atropia. Benger mentions the recent successful use of a glycerole of the Calabar bean (physostigma venenosum).

For the extraction and preservation of vegetable principles, glycerin is very valuable. Startin ob-

[1] Pharm. Journ. and Transac., London, Nov. 1864. This writer prefers for "plasma," after trial of various forms of starch, the *tous-les-mois*. His method is, to rub 50 gr. of this in a mortar with 1 ounce of glycerin, transfer to a porcelain evaporating dish and heat over a gas flame to 240°, constantly stirring with a wooden spoon or ivory spatula, until it becomes transparent.

served (*loc. citat.*) that "syrups and extracts by its means are kept from evaporation to dryness, as also from fermentation, and from the formation of cryptogamic vegetation or mouldiness." Cap and Garot confirmed this statement. John S. Blockey, in the London Chemist, September, 1857, recorded some facts of the same kind; and in the Transactions of the American Pharmaceutical Association for 1857,[1] F. Stearns, of Detroit, gave as examples of its utility "the extraction of the active matters of the leaves of savin, stramonium, cicuta, dulcamara, elder, tobacco, etc.," and its substitution for sugar in syr. ipecac., syr. scill. comp., etc. A. F. Haselden[2] urged similar views in the London Lancet, in 1858. Dr. W. R. Gore,[3] of Limerick, cited his own experience as well as that of Dr. Jacob, as to its favorable action in admixture with ext. belladonnæ, ext. valerianæ, ext. opii, aconit., etc., to maintain their softness. T. S. Wiegand, in a communication to the Am. Journal of Pharmacy,[4] speaking of "the difficulty of incorporating extracts in ointments, syrups, and mixtures," says that "the most simple and unexceptionable method is to work up any given extract with an equal weight of pure glycerin,

[1] P. 138.

[2] *Vide* Am. Druggists' Circular, Aug. 1858, p. 166.

[3] Dublin Med. Press, Dec. 26, 1860.

[4] March, 1863.

added gradually during the process of mixing it." Of course double the weight of the extract prescribed must be used when thus prepared.

At the meeting of the Am. Pharmaceutical Association, held in 1864, at Cincinnati, the following question was brought up for answer: "Is there an eligible method by which all the medicinal matter of Cinchona may be held in a permanent solution without deposition of cincho-tannates or cinchonic red?" This was answered by A. B. Taylor of this city, with the exhibition of a solution of the active principles of cinchona in glycerin, which was judged to meet the desideratum in view.[1]

Among the preparations difficult to keep, iodide of iron has always attracted attention. In glycerin instead of syrup (*Liquor Ferri Iodid.* formerly, *Syrup. Ferri Iodid.* of the new Pharmacopœia) it is a sufficiently stable preparation. Leamy's formula for this glycerole is probably the best.[2]

Take of Resublimed Iodine, ℥j;
Iron Wire, q. s.;
Glycerin (pure), ℥x;
Distilled Water, ℥j vel. q. s.

Mix the iodine with the water in a porcelain capsule, and gradually add the iron wire, stirring

[1] Am. Journ. of Pharmacy, Nov. 1864, p. 479.

[2] Transac. of Am. Pharmaceut. Assoc., 1857, p. 90.

constantly. Heat the mixture until it acquires a light-greenish color, then filter the solution into a capsule containing five ounces of the glycerin, taking care to keep the end of the funnel under the surface of the glycerin; then place the vessel containing the solution and the glycerin on a water-bath, and evaporate until it measures five ounces. Add to this the remaining five ounces of glycerin, previously placed in a twelve-ounce bottle, and shake well together. This preparation is of a pale-straw color, entirely free from sediment, and will keep for any length of time. The dose is the same as that of the officinal syrup.[1]

Glycerole of aloes, first proposed by M. Chausit, was improved by A. F. Haselden,[2] as follows: Mix well in a mortar four drachms of finely powdered Socotrine aloes and four ounces of pure glycerin; transfer them to a bottle; agitate occasionally for a few days, and then, if all the aloes be not dissolved, digest for fifteen minutes with gentle heat by means of a water-bath; strain them through linen to separate any small portions of dirt which may be present. The result is a bright, mahogany-colored syrupy liquid.

Glycerole of lead was suggested as a substitute

[1] Other formulæ for the combination of iodide of iron with glycerin are to be found in Am. Druggists' Circular, Aug. 1st, 1858, p. 166, and July, 1858, p. 130.

[2] London Pharm. Journal, Dec. 1859.

for Goulard's cerate (objected to on account of its speedy rancidity) by Charles Tilyard.[1] He directs the following: Take of pure glycerin, 13½ fluidounces; solution of subacetate of lead, 2½ fluidounces; camphor, ½ drachm. Triturate the camphor into powder with a few drops of alcohol, add the glycerin, heat in a water-bath until the camphor is dissolved; when cool add the solution of lead and shake well together. The strength is about equal to that of Goulard's cerate. In Parrish's Pharmacy[2] we find designated as "Linimentum Plumbi Subacetat.," a mixture of equal parts of solution of subacetate of lead and glycerin.

On the same page of that work is given also Prof. Procter's "Linimentum Aconiti Radicis;" thus: Macerate four ounces of powder of aconite root with half a pint of alcohol for twenty-four hours, then pack it in a small displacer and add alcohol gradually, till a pint of tincture has passed. Distil off twelve fluidounces, and evaporate to twelve fluidrachms; to this add two fluidrachms of alcohol, and two fluidrachms of glycerin. This is intended to take the place of ointment of aconitia as an external application.

F. Stearns, on account of the objections existing to all the ordinary preparations of lactucarium,

[1] Journal Trans. Maryland Coll. of Pharmacy, June, 1859.

[2] P. 659.

proposes a glycerole of it. The faults alluded to, viz., want of permanence, too great dilution, excess of alcoholic menstruum, and disagreeable taste, may thus all be obviated. This is his process:[1]

Take of Lactucarium one troyounce; reduce it to powder; moisten it with one fluidounce of alcohol, and pack it into a small displacement apparatus; after twelve hours, pour upon it, gradually, diluted alcohol, until the filtrate measures 16 fluidounces, or until the fluid passes without sensible taste of bitterness; evaporate this filtrate upon a water-bath nearly to dryness, or to the consistence of an extract; then treat this residue with 6 fluidounces of boiling water, continuing the heat for a little while; after which pour it off from the undissolved residue into a filter placed in a bottle containing 12 fluidounces of pure glycerin. Repeat this operation with 4 fluidounces of water added to the undissolved residue of the extract; then evaporate the whole upon a water-bath to 14 fluidounces, and, when cool, add 2 fluidounces of orange-flower water, in which has been dissolved 15 grains of citric acid. Each fluidounce represents half a drachm of lactucarium. The dose is from one to three or four teaspoonfuls.

"Herapath's Quinine," or Iodo-sulphate of Qui-

[1] Am. Druggists' Circular, June 1, 1858, p. 135.

nine, is said to make a clear, amber-colored solution in glycerin, which may be made of the strength of eight grains in the ounce, one drachm the dose.[1] Glycerole of Sulphate of Quinine is an elegant preparation, which may contain either 1 grain or 1½ gr. to the fluidrachm. The ammonio-citrate of iron and quinine T. S. Wiegand finds to dissolve perfectly in glycerin. I would propose such a glycerole containing 10 grains of the salt in the fluidounce, as an excellent mode of combining iron with quinine in the liquid form. F. B. Benger makes a glycerole of carbonate of iron by dissolving separately, each in 2 fluidounces of glycerin, 76 gr. of sulphate of iron and 60 gr. carbonate of potassa, and mixing the solutions.

M. Martinet[2] recommends highly as a surgical disinfectant, etc., a glycerole of chlorate of potassa;

[1] Iodo-sulphate of quinine may be made in the following manner: Put a solution of 100 grains of commercial sulphate of quinine into a mixture of one drachm of acetic acid and seven drachms of diluted alcohol, heated to 125° or 150° F., and add strong tincture of iodine, drop by drop, constantly stirring until the liquid ceases to lose color. Allow the liquid to rest away from the fire for two or three hours; when there will be deposited a large quantity of emerald green crystals. These and the liquor are to be thrown on a filter and suffered to drain; then washed freely in cold water, dried and bottled.—*Am. Druggists' Circular*, Oct. 1860, p. 285.

[2] Journ. de Chim. Méd., June, 1861.

ten parts of the latter dissolved in one hundred of the menstruum. Grimault[1] introduced a "liquid sinapism," consisting of a preparation of pure glycerin 14 drachms, starch 20 drachms, oil of mustard 80 drops, mixed well together. This may be bottled, ready at any time for immediate use.

In the Royal Ophthalmic Hospital a "plasma" of sulphate of copper has been used; made by dissolving 24 grains of the salt in $10\frac{1}{2}$ drachms of glycerin, and adding $1\frac{1}{2}$ drachms of powdered starch, heating it until the proper consistence is acquired.

Glycerole of alum and white precipitate was much lauded by M. Anciaux (before quoted) as an external application in erysipelas. It was made by triturating together $1\frac{1}{2}$ ounces of finely powdered alum and 15 grains of white precipitate, and then shaking this powder well with 20 ounces of glycerin. The mixture is cream-like, but must be shaken when used.

J. J. T. W. Smith proposed in the London Pharmaceutical Journal, in 1858, as a basis for ointment, a union of glycerin with *fuller's earth*. The latter is to be first slaked with a little water, and passed through a fine sieve; then it may be mixed in equal parts with pure glycerin. The bland qualities of fuller's earth promise to make this an available material.

[1] Journ. de Chim. Méd., June, 1861.

A beautiful substitute for the "unguentum aquæ rosæ" is the following:—

Take of almond oil expressed, 2 fluidounces; spermaceti, 6 drachms; glycerin, 4 fluidrachms; otto[1] of roses, and otto of bergamot, each 2 drops. Melt the spermaceti by the aid of a water-bath, add the almond oil so gradually as not to recongeal any of the spermaceti, remove from the bath, and stir till the mixture concretes on cooling, when the glycerin is to be added and thoroughly incorporated; finally add and incorporate the ottos, and the ointment is ready for employment.

A pleasant glycerin lotion is prepared thus:—

Take of mucilage of quince seeds and glycerin, each, 1 fluidounce; mix, and add 6 fluidounces of orange-flower water. C. A. Bannvart advises the simple addition of one drachm of glycerin to one ounce of rose water; which, under the name of "glycerin water," many have found an admirable emollient for the face after shaving, or for chapped lips or hands, etc. For a throat or mouth wash M. Blache and others have used 2 drachms of biborate of soda in 1 ounce of glycerin: 2 scru-

[1] So spelled (not attar) in the pharmaceutical journals. The recipe above given is Jos. Laidley's. Am. Jour. of Pharm., 1850, p. 118. Ecky's glycerin ointment contains spermaceti $\frac{1}{2}$ ounce, white wax 1 dr., oil of almonds 2 fl. oz., glycerin 1 fl. oz.; the first three ingredients being first melted and mixed, and then the glycerin incorporated with them. Am. Dispensatory, art. Glycerin.

ples of borax in 4 ounces of glycerin, Dr. Brinton prescribed for cracked tongue.

Gibert's "glycerole de goudron" has already been described. A simple glycerole of tar (for use like tar ointment) may be made by mixing equal parts of tar and glycerin and straining. It has a dark amber color and an oily consistence (Cap and Garot). Schacht proposed a "plasma petrolei;" which, as the latter article is now abundant and is attracting much attention, ought not to be overlooked.

℞.—Petrol. ℥j;
Glycerin (pur.) f℥j;
Amyli, gr. lxx.

Rub the starch with the petroleum till smooth, add gradually the glycerin, and heat to 240° Fahr. For "plasma hydrargyri" the same author recommends mixing 14 drachms of starch with 6 drachms of glycerin, gradually adding 12 ounces of mercury, stirring till the globules disappear, and then adding 6 more fluidrachms of glycerin, and heating to 240° Fahr., stirring all the time.

Here is M. Bourbignon's "aristocratic" recipe for itch, before alluded to:—

Yolks of eggs, 2; essences of lavender, citron, and mint, each, 5 grammes;[1] essences of canella and clove, each, 8 grammes; gum tragacanth, 2

[1] A *gramme* is 15·434 grs. Troy.

grammes; sulphur, well pounded, 100 grammes; glycerin, 200. Mix well the essences with the yolks, add the gum tragacanth; then to the mucilage add very gradually the glycerin and sulphur.

Equal parts of *soot* and glycerin were used by M. Bougard with "astonishing effect" in the treatment of obstinate chronic eczema.[1]

I would suggest the employment of glycerin instead of olive oil in the disinfectant dressing of MM. Demeaux and Corme,[2] composed of 100 parts of finely powdered plaster of Paris, with 1 to 3 parts of coal tar, afterward made into a paste with oil. The antiseptic property of the glycerin itself would make it suitable for this admixture.

Max Richter's "iodized glycerin" has been mentioned. It is a semi-caustic substance, made by dissolving 1 part of iodide of potassium in 2 parts of glycerin, and pouring this liquid on 1 part of iodine.[3] Several escharotics, according to Stearns (loc citat.), are, on account of their deliquescence, particularly available in solution in

[1] Journ. de Méd. de Bruxelles, Sept. 1856.

[2] Am. Journ. of Med. Sciences, Jan. 1860, p. 219.

[3] An oversight occurs (for which other writers quoted are responsible) in Prof. Stillé's Therapeutics (vol. i. p. 157, 1st ed.) in speaking of a *solution* of 1 part of iodine in 5 of glycerin. Iodine *alone* requires a very much larger amount of glycerin to dissolve it.

glycerin; as terchloride of antimony, iodide and chloride of zinc, nitrate of mercury, chromic acid, etc. The disagreeable sulphurets may also be advantageously dissolved in it.

MM. Bonnet[1] and Debout recommend the suspension of chloroform in glycerin as the best method for its internal administration. The former combines them in equal proportions; the latter, 1 part of chloroform to 15 of glycerin. Both direct that the two substances should be *beaten together in a mortar;* and this is *indispensable.* We have found on trial that, in a bottle, no amount of shaking will prevent the chloroform from separating at once on standing, and sinking to the bottom.

Glycerin mitigates essentially the unpleasant taste of cod-liver oil. The two substances require agitation, with or without a small portion of gum acac., to mix them together. The following may be said to be an almost *agreeable* preparation, which does not leave behind it the nauseous aftertaste of the fish oil:—

℞.—Ol. Morrhuæ, et
Glycerin, āā f℥ij;
P. Gum. Acac. ℥j;
Ol. Amygd. Amar. gtt. j;
Ol. Caryophyll. gtt. xij. M.

The "Mistura Amygdalæ" of the Pharmaco-

[1] Bull. Gén. de Thérap., April 15th, 1861.

pœia, made with $\frac{1}{4}$ of the amount of *bitter* almonds, and added to the same quantity of glycerin, will disguise the taste of an equal quantity of cod-liver oil.

I have ascertained that some *chalybeates* neutralize the *odious* quality of cod oil. The following leaves no after-taste at all, and is an excellent recuperative prescription :—

℞.—Ammonio-ferri et Quiniæ Citrat. gr. x;
Ol. Morrhuæ, et
Glycerin, āā f℥ij. M. ft.
S. f℥ss. p. r. n.

Agitate well before administration.

Quinine has its bitterness much lessened, but not destroyed, by solution in glycerin. The tannate of quinine, which has but little taste, will scarcely dissolve in glycerin at all.

One of the important uses of glycerin in pharmacy is, *to prevent pills from drying and becoming hard.* Startin noticed this twenty years ago. In some experiments made in 1850, S. E. Shinn[1] demonstrated its value for this purpose, especially in the preparation and keeping of pills of sulphate of quinine.

M. Reveil,[2] and Dr. Andrews,[3] of Chicago, have

[1] Am. Journ. of Pharmacy, 1850, p. 127.
[2] W. A. Smith, *op. citat.* p. 36.
[3] Stillé, Therapeutics, *loc. citat.*

stated that *vaccine virus* immersed in or mixed with glycerin will retain its powers for several months. This has not yet been confirmed by other observers. A hermetically sealed tube would probably answer at least as well for the same end.

F. Stearns remarks[1] that "there seems to be scarcely a fraction as yet developed of the uses to which this wonderful substance can be applied in pharmacy."

Summary.

Before passing to the non-medical uses of glycerin, I desire to invite the attention of the reader again to some of the principal points considered in the preceding pages, upon the chemical, therapeutical and pharmaceutical relations of our subject.

1. Glycerin is not a fat, nor a sugar; but, chemically, an alcohol.

2. For use by the physician or druggist it must be absolutely *pure;* free from chlorine, lead, lime, sulphuric acid, volatile fatty acids, and glucose; and both colorless and *inodorous.* Bower's and Price's manufacture will come up to this standard.[2]

[1] Trans. of Am. Pharm. Assoc., 1857, p. 138.

[2] The best that I have been able to obtain from any other source but those above mentioned, has a perceptible and somewhat disagreeable odor when rubbed upon the hand; besides giving *copious* precipitates with solution of nitrate of silver, and with chloride of barium; which do not at all affect strictly pure glycerin.

3. Externally applied, glycerin has no *specific* influence over cutaneous disorders, but is an excellent emollient, especially in *erysipelas, prurigo, scaly eruptions, burns,* and *gangrenous wounds.* It may be made the vehicle for any of the preparations used for skin diseases; may be diluted if necessary for open, fresh wounds, and may have *bromine, carbolic acid,* etc. dissolved in it for gangrene.

4. The preparation most widely approved, as a substitute for ointment, is *glyceramyl or plasma;* composed of glycerin and starch, mixed with the aid of heat. The proportions may vary; but are usually about 1 part of starch to from 5 to 8 or even 16 parts of pure glycerin. A little glycerin added to an ordinary poultice will keep it from becoming dry and hard. A glycerole of soap is mentioned by Dr. W. A. Smith, consisting of from 1 to 4 parts of animal soap, powdered, mixed with 30 parts of glycerin, and dissolved by heating it in a water-bath.

5. Glycerin may be used as an adjuvant to the bath (12 ounces or more at once); softening the skin pleasantly. After bathing, a few drops of it, poured upon a sponge and rubbed over the body, will have a very comfortable effect.

6. Internally, glycerin is a mild laxative; in the dose of 1 to four drachms, it is especially available for children.

7. It cannot be relied upon as an *analeptic* in phthisis; but may be useful as an expectorant.

8. In pharmacy, glyceroles are more stable than aqueous, oleaginous, or saccharine preparations, while they are less stimulant, and generally more agreeable, than alcoholic tinctures. Glycerole of quinine, of iodo-quinine, of iodide of iron, of subnitrate of bismuth, of lactucarium, of atropia, and of acetate of lead have been considerably used. Among many others that have been suggested, that of ipecac. is particularly desirable, on account of the great fermentability of the ordinary syrup. I would add, also, especially, the following:—

Glycerole of Quinia with Strychnia.

℞.—Strychniæ, gr. j;
Quin. Sulphat. ℈ij;
Glycerin, f℥iv. M. ft. sol.

Dose, a fluidrachm.

A combination of nux vomica with quinine has recently been found valuable in the cure of obstinate *chronic intermittents*, which resisted quinine alone. The above preparation will answer for the same purpose.

Glycerole of Ammonio-citrate of Iron and Quinine.

℞.—Ammonio-ferri et Quiniæ citrat. ℈ij;
Glycerin, f℥iv. M. ft. sol.

Dose, one or two fluidrachms.

The addition of this to cod-liver oil destroys the nauseousness of its taste and effect; especially with the further addition of one or two drops of oil of cloves to each ounce of the mixture.

Glycerole of the Sulphites of Soda and Magnesia.

Worthy of careful and extensive trial as *anti-zymotic;* upon the idea of Polli (Am. Journ. of Med. Sciences, April, 1863, p. 467, and Jan. 1865);[1] in diphtheria, etc.

Glycerole of Phosphate of Iron.

℞.—Ferri Phosphat. ℥j;
Glycerin, f℥iv. M. ft.

Dose, two fluidrachms.

This requires slight shaking when given, although nearly the whole is dissolved.

Glycerole of Oxide of Zinc.

℞.—Zinci oxid. ℥ss;
Glycerin, f℥iv. M. ft.

S. Shake before using. For external application.

[1] *Vide* Dr. W. F. Atlee's account, in that journal (Jan. 1865, p. 82), of the good effects of sulphite of soda in pyæmia; and M. Carey Lea's paper, in the same number (p. 84), on the Transformation of Sulphites in the system.

I advise this as an emollient for severe *burns*, and in *eczema, herpes, pemphigus*, etc.

Glycerole of White Lead.

℞.—Plumb. Carbonat. ℥j;
Glycerin, f℥iv. M. ft.

This is an almost perfect solution, all of the carbonate being suspended on slight agitation. It is recommended to be applied to the edge of the lids with a hair pencil, in *conjunctivitis*, or *general ophthalmia*, acute or chronic; to *inflamed hemorrhoids*, and to the surface over bones affected with *periostitis*, of scrofulous or other origin. In the last-named affection, I have found carbonate of lead of remarkable utility; and glycerin will introduce it more readily than any unguent.

Many other applications of the same or other similar preparations might be suggested. I cannot pretend to exhaust the subject. Yet, in the American Pharmacopœia, but a few lines are given to Glycerin, and none to any of its preparations; and in the British Pharmacopœia, it is merely mentioned as a solvent for tannin in *supposit. tannic.* It can hardly be much longer left to so insignificant a share of officinal recognition.

Uses in the Arts, etc.

Warren de la Rue proposed the use of glycerin with alcohol or pyroxylic spirit as an illuminating material. I do not know of the idea ever having been carried out extensively.

In gasometers, F. Crace Calvert speaks of its employment with water to diminish the amount of evaporation. In gas-meters, which are exposed to a low temperature in winter, it is better than alcohol for the same reason; while its difficulty of congelation is as great, and it is safer because of its being less inflammable.

It has been spoken of as an available material for lubricating machinery, on account of its uniform and permanent fluidity.

Manufacturers of chewing tobacco find it very convenient to maintain the softness of their product, while imparting sweetness to it.

It is used for the preservation of copying ink, and water-colors; and for the improvement of soaps, and of applications for the hair.

When added to a soap solution, it increases the facility of forming bubbles to an extraordinary degree. By its aid, bubbles of some seven or eight inches in diameter can be produced, according to Calvert, which exhibit most elegant purple and

green colors; the beauty of which is much enhanced by the electric light. To produce this peculiar solution, mix 5 ounces of distilled water with $\frac{1}{8}$ of a drachm of soap and 2 drachms of glycerin.

I find the following receipt for a "glycerin paste for office use."[1] Take of gum arabic, 1 oz.; boiling water, 3 oz.; glycerin, 2 drachms; make a solution. Cap and Garot mention that 5 parts of glycerin and 1 of gum arabic make a transparent mucilage: 1 part of glycerin to 3 parts of powdered gum arabic unite to a thick mass, which, when spread, adheres well and is very flexible. A few drops of glycerin added to the court-plaster mass make it pliant, and prevent the spread plaster from cracking.

With 100° of heat, glycerin will dissolve albumen, in almost any proportion; the solution will remain for a long time without decomposition, even in warm weather.

C. Sellers, of this city, some time since proposed the use of glycerin in photography, to keep pictures in an unfinished state. It has been, in this way, found to be very serviceable, especially to traveling photographers.

Waring long ago made known its value for the preservation of objects for microscopical examina-

[1] Am. Druggists' Circular, April, 1858.

tion. It appears to alter organic solids less than alcohol, and to be a potent antiseptic.[1]

For the curing of meat it is liable to the objection that the sweet taste it gives is quite difficult to remove, while it is also more expensive than the other common preservatives.

The latter reason applies to prevent its substitution for sugar in the preserving of fruit. It may, however, be added with advantage to materials used for that purpose.

Mustard may be kept liquid for any length of time by admixture with it. I suggest its use for the keeping of *rennet.*

G. F. Wilson, in a paper referred to before, describes the effect of glycerin in keeping the colors of organic bodies. "Our first experiment," says he, "was upon a brilliantly colored two-pound trout, caught in one of the Pertshire lochs. On taking it from the water I poured a quantity of glycerin over it, and wrapped it in a cloth. At night the fish was cleaned and immersed in glycerin. Next day it was again wrapped in a saturated cloth. On examining it a day or two afterward, in Edinburgh, the color on the scales was unchanged. When it arrived in London, part was steeped in water and cooked. Though perfectly

[1] Assistant Surgeon J. J. Woodward, U. S. A., refers favorably to its use in microscopy, in the Am. Journ. of Med. Sciences, Jan. 1865, p. 111.

fresh and firm, it had lost all its flavor. The uncooked portion was sent to Professor Owen, who suggested that the brilliantly tinted fishes of the Coral Islands and tropical coasts might be brought home in kegs of glycerin." After one or two months, the colors of trout, roach, and perch, immersed in this liquid, continued bright.[1]

At the Museum of the Faculty of Medicine, in Paris, says Dr. W. A. Smith,[2] glycerin has been recently adopted as a preservative fluid for flowers and fresh plants, which are immersed in large vessels containing this substance. The external condition of vegetable structures is very slightly altered, as the green coloring matter is not dissolved, so that the green parts all retain their natural hue; the corollas of the flowers also present their usual appearance, with the loss only of some of their brilliancy. It is possible that this property of glycerin might be applied in some way to the preservation of plants for the herbarium.

The following account is abstracted from a paper read at the Bath meeting of the British Pharmaceutical Conference, September, 1864, by C. R. C. Tichborne, F.C.S., and published in the London Pharmaceutical Journal.[3]

Having observed that a vegetable curiosity

[1] London Pharmac. Journ., Nov. 1855.

[2] *Op. citat.* p. 35. [3] November, 1864.

which he had immersed in glyeerin was preserved unehanged, he thought of making it also available in keeping elder, orange, or rose flowers; and in substituting oils and fats in "enfleurage." His experiments were quite successful. The process was, to pack the flowers in a wide-mouthed bottle, eover them with pure, *inodorous* glyeerin, and eork the bottle. For use, express the glyeerin, whieh eontains the aroma; add water, according to the original weight of the flowers, or the amount of distillate required, and distil. Mr. Tiehborne has so kept flowers for two years, and then made from them a water with a perfume equal to that of the flowers of the season.

With flowers whose aroma is so delieate as to be injured by heat, this material is particularly useful in a similar mode. Cold maeeration is practised, and after the flowers have been digested for some time, the glyeerin is expressed and treated again with flowers, until it is eompletely saturated with the odorous substanee. Glyeerin has a very strong affinity for fragrant essences. The saturated glyeerin is then diluted with water and shaken with a small quantity of ehloroform. After being well agitated, it is allowed to subside; it earries down with it nearly the whole of the essential oil. The ehloroformic solution, after being separated by a funnel, should be filtered if necessary, and allowed to evaporate spontaneously in

shallow vessel. The residual matter, dissolved in spirit, forms the spirituous extract of the flower, whatever that may be.[1]

To conclude: it has been truly remarked by Wilson, that "in glycerin there is a wide field opened, requiring many scientific and practical laborers; and which, once fully worked, will yield a tenfold crop of uses. Pure glycerin will then take its proper place, among the most valued of modern products, in the arts as well as in medicine."

[1] The same portion of glycerin may be used repeatedly, by diluting it, passing it through charcoal and evaporating it. In France, 2,284,000 pounds of flowers are grown annually for their perfumes.—*Tichborne.*

THE END.